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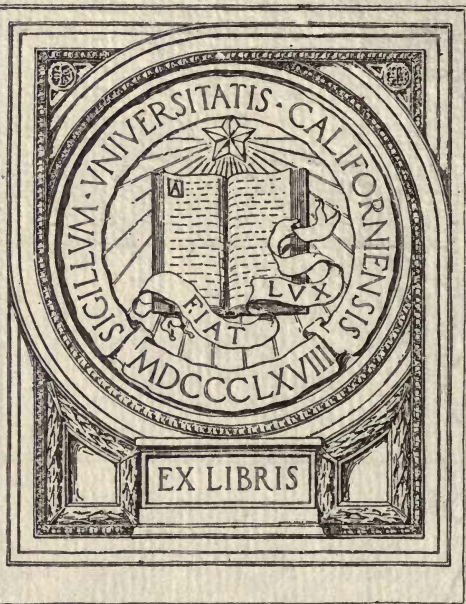
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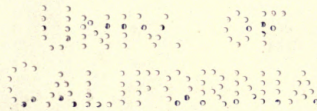


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SPECIFICATIONS

For the Construction *of*
VITRIFIED BRICK
STREET PAVEMENTS
and
VITRIFIED BRICK
HIGHWAYS



NATIONAL PAVING BRICK
MANUFACTURERS ASSOCIATION

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National Paving Brick Manufacturers Association

of this country was organized for
the following purposes :

- 1st. A dissemination among its membership of technical knowledge relating to the manufacture of their product.
- 2nd. To bring to the attention of the public the merits of Vitrified Brick as a paving material.
- 3rd. To influence to the greatest possible extent the proper construction of brick streets.
- 4th. For furnishing truthful and reliable information regarding other paving materials, and their comparative value as pavements when considered with brick pavements.



NATIONAL PAVING BRICK
MANUFACTURERS ASSOCIATION

Will P. Blair, Secretary

Engineers Building, Cleveland

ANNOUNCEMENT

The National Paving Brick Manufacturers Association from its organization has steadfastly adhered to the belief that what is best for the users of vitrified brick is likewise best for the industry. In serving this purpose the Association has issued from time to time a large number of editions of Specifications and Directions for Laying Vitrified Brick Street Pavements. These have been revised from time to time.

In the belief that still further improvement was possible, both in the matter of convenience as well as improvement of the text, a committee was appointed at a meeting of the Board of Directors of the Association held in New Orleans in March, 1914, to prepare a revision of the specifications which would include matter covering the construction of country highways.

This revised edition of 1914 is now offered to the engineers and the public. It is published with a view of making it particularly convenient to the engineers who can readily apply it to such other specifications as cover local requirements and conditions.

No comments or "reasons why" will be offered. Illustrations of finished work and steps in construction will be included.

There is, however, a very great demand for a publication in the nature of a hand book which is being prepared supplementing these specifications which shall include such reasons, directions and discussions as can not appropriately be incorporated into the specification itself.

We cannot but entertain the hope that this edition will be received with favor from the engineers throughout the country, as upon them the industry must rely for co-operation in service for public benefit.

NATIONAL PAVING BRICK
MANUFACTURERS ASSOCIATION



Mentor Avenue, at the intersection of West 15th Str., Cleveland, Ohio

SIMILAR residential districts are included in approximately seventy-five percent of the street mileage in our American Municipalities.

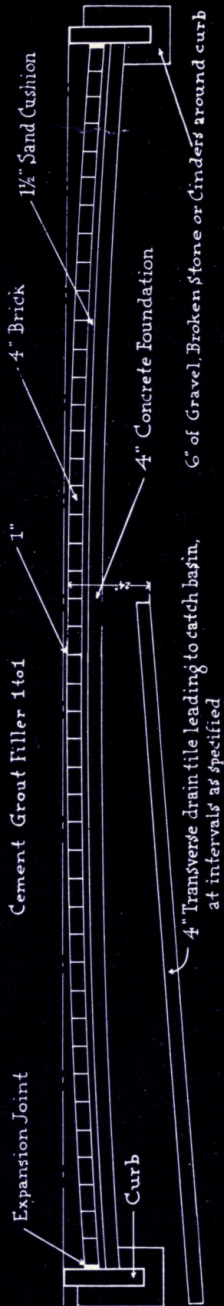
The scene on opposite page is Mentor Avenue at the intersection of West 15th Street, Cleveland, Ohio. This particular pavement was laid in 1898. The foundation is of natural earth. The cushion is a two inch sand cushion. The drainage sustains a dry sub-base. The use and wear of the street has super-induced a slightly better condition with age. The sanitation afforded is ideal. Traction resistance at a maximum.

It has had no repairs. Its age demonstrates its durability. In the construction of this street the specifications herein were followed, using the alternate "brick pavement on natural earth without an artificial foundation."

Conditions of traffic and surroundings of seventy-five percent of street mileage of American municipalities are not exceeded in any particular by those found in this scene.

320776

Vitrified Brick City Street Pavement Cross Section



THIS diagram of Cross Section suggests a too often overlooked, but one of the most important features of street or road construction—Drainage. The drainage design should be placed according to local conditions to secure a dry sub-base.

Specifications *for the* Construction of Vitrified Brick Street Pavements

GRADING

Section 1. The roadway herein provided to be improved, including the approaches thereto, shall be graded to such grades, sub-grades and cross-sections as are shown by the plans of the engineer.

The Roadway

Section 2. Earth in excavation shall be removed with plow and scraper, or other device, to such a depth as when rolled will conform to the true sub-grade. The roller for this purpose should be three wheeled, self-propelling and should weigh not less than six (6) nor more than ten (10) tons. No dirt from the excavation shall be deposited against or upon any material, brick or stone to be used in the pavement.

Earth in
Excavation

Section 3. Earth in embankment must be applied in layers of not more than six (6) inches in thickness, and each layer thoroughly rolled. Spongy and soft earth that cannot be made firm by rolling should be removed and replaced with suitable material. Careful attention should be given to bring the entire sub-grade to a uniform density.

Earth in
Embankment

Section 4. After the roadbed or foundation has been completed ready for the pavement, no loaded or empty wagons or other vehicles that might disturb the finished surface shall be permitted thereon, unless the surface is properly protected.

Protection of
Sub-Grade



DRAINAGE

Drainage

Section 5. Drainage should be provided sufficient to rapidly remove all water from the roadway to a depth of not less than eighteen (18) inches below its finished surface, and the engineer shall examine the location and provide ample plans and specifications to accomplish this result.

STONE CURBING

Hauling and Placing

Section 6. All curbing shall be hauled, distributed and set before grading is finished, and may then be used as a guide to finish the sub-grade. It shall be of a character and of such dimensions as described in these specifications. At street corners it shall be set to a radius of feet; at alleys the radius shall be feet.

Quality

Section 7. Curb stone shall be of the best quality of hard stone, compact and homogeneous, and free from cracks, pockets, lumps, seams or other defects, and equal in every respect to samples furnished by the contractor. Curb stone shall be slabs inches in depth by not less than feet in length and the top edge must be dressed to a uniform thickness of inches. It shall be dressed on its face to the depth of the top of the foundation and on the back for a depth of not less than three (3) inches from the top. The ends shall be dressed at right angles to the top to the same depth as required for the face.

Setting

Section 8. The curb shall be set true to line and grade as furnished by the engineer, and the ends joined and pointed with a mortar composed of two (2) parts of sand and one (1) part of cement.

Marginal Curb

Section 9. At the end of the pavement and at the end of the street and alley intersections, a marginal curb of the material described for curbing shall be placed to conform to the cross-section and to a depth of not less than twelve (12) inches.

CONCRETE FOUNDATION

Section 10. Cement used in the work shall meet the requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials, adopted August 16, 1909, with amendments and additions thereto adopted by said Society.

Cement

Section 11. Water used in mixing the concrete shall be clean, free from oil, acid, strong alkalies or vegetable matter.

Water

Section 12. Fine aggregate shall consist of screenings from hard durable sand, gravel, granite or other hard rock and must not contain more than five (5) per cent of clay. It shall be reasonably uniformly graded from a size which will pass through a one-fourth ($\frac{1}{4}$) inch screen down. Sand containing disintegrated shale or slate shall not be used.

Fine Aggregate

Section 13. Coarse aggregate shall consist of sound gravel, stone, vitrified clay or slag. It shall be free from all foreign matter, uniformly graded, and shall range in size from one-fourth ($\frac{1}{4}$) inch up to that which will pass a one and one-half ($1\frac{1}{2}$) inch revolving screen.

Coarse
Aggregate

Section 14. The cement and aggregate shall be measured separately and then mixed in such proportions that the resulting concrete shall contain fine aggregate amounting to one-half ($\frac{1}{2}$) of the volume of the coarse aggregate, and that.....cubic feet of the concrete in place will contain ninety-four (94) pounds of cement.

Concrete
Proportions

Section 15. The ingredients of the concrete shall be thoroughly mixed, sufficient water being added to obtain the desired consistency, and the mixing continued until the materials are uniformly distributed, and each particle of the fine aggregate is thoroughly coated with cement and each particle of coarse aggregate is thoroughly coated with mortar. A batch concrete mixer must be used, the materials must be proportioned dry, and then deposited in the mixer all at the same time. The mixer must produce a concrete of uniform consistency and color, with the stones thoroughly mixed with the water, sand and cement.

Mixing



Concrete Foundation—See Sections 16, 17 and 18

Section 16. The materials shall be mixed wet enough to produce a concrete of a consistency which can be handled without causing a separation of the coarse aggregate from the mortar while being spread into position with a template, straight edge or back of a shovel.

Consistency

Section 17. Retempering, that is, remixing with additional water, mortar or concrete that has partially hardened, shall not be permitted. No concrete shall be mixed while the air temperature is below 32 degrees F. except with the consent of the engineer.

Precautionary Measures

Section 18. The concrete shall be deposited in a layer on the sub-grade in such quantities that it will be of the required thickness and the upper surface shall be smooth, true, uniform and parallel with the surface of the finished pavement and must not exceed a limit of one-half ($\frac{1}{2}$) inch from the true surface. In conveying the concrete from the place of mixing to the place of deposit, the operation must be conducted in such a manner that no mortar will be lost and the concrete must be so handled that the foundation will be of uniform composition throughout, showing no excess or lack of mortar in any place. If the sub-grade is exceedingly dry it shall be moistened.

Placing Concrete

Section 19. This foundation shall be inches in thickness, with its upper surface finished to inches below the grade of the finished pavement.

Thickness

Section 20. When complete, the foundation shall be kept moist for not less than two (2) days. No loaded or empty wagons or other vehicles that might disturb the finished surface shall be permitted thereon, unless the surface is properly protected.

Protection

CUSHION

Character of Material

Section 21. Upon the foundation shall be spread a cushion which will be one and one-half ($1\frac{1}{2}$) inches in depth after the same has been thoroughly and firmly compacted by rolling. The material for this cushion shall consist of granulated slag, stone dust, or a loamy sand which will firmly compact by rolling and must pass a quarter ($\frac{1}{4}$) inch screen.

How Spread and Prepared

Section 22. The cushion must be carefully shaped to a true cross-section, parallel with the finished roadway, by means of a template covering at least one-half ($\frac{1}{2}$) of the width of the brick work, and so made as to be easily drawn over the curb or guide rail. Guide timbers shall be one and one-half ($1\frac{1}{2}$) inches by four (4) inches, and not less than fourteen (14) feet in length, and laid to a true line parallel with the grade in the center of the street and next to the curb (if top of curb cannot be used). Before shaping the cushion, a one-half ($\frac{1}{2}$) inch strip shall be laid on the curb or guide rail and strip of same thickness laid on guide timbers in the center of street, and a template drawn over the same leaving the cushion complete in place one-half ($\frac{1}{2}$) inch above the surface required, after which the one-half ($\frac{1}{2}$) inch strip shall be removed and the surface rolled thoroughly with a hand roller. After rolling, the template shall be drawn over the curb and guide timbers to complete the cushion. If the cushion should not be uniformly compacted and parallel to the surface of the finished pavement, the operations shall be repeated. The operations of shaping the foundation for the pavement and of compressing and shaping the cushion for the brick are considered of prime importance in securing the desired evenness in the surface of the finished pavement, and the contractor will be required to equip himself with the proper implements approved by the engineer and to secure skilled men for this part of the work. The roller for rolling the cushion shall weigh not less than ten (10) pounds per inch in length and should be approximately twenty-four (24) inches in diameter and not more than thirty (30) inches in length and may be in sections.



Sand Cushion—See Sections 21 and 22

EXPANSION JOINTS

Expansion Joints

Section 23. Expansion joints shall be placed parallel with and at each curb line and extend across each street and alley intersection. It should be one-half ($\frac{1}{2}$) of an inch in width for streets less than twenty (20) feet wide; three-fourths ($\frac{3}{4}$) of an inch for streets from twenty (20) to thirty (30) feet wide and one (1) inch in width for streets wider than thirty (30) feet. This joint must extend to the depth of the brick. No transverse joints shall be allowed. A prepared bituminous material that will remain pliable at all temperatures to which it may be subjected as a street paving filler shall be used for this purpose. The material should be made into strips of suitable length and of the required depth and thickness and should be laid in the pavement with the ends closely joined as the bricks are being laid.

BRICK

Quality and Character

Section 24. The contractor must submit samples and name the brand of brick with prices respectively upon which he submits bids. The brick must be of the quality and size commercially known as vitrified paving block. They should be reasonably straight, uniform in size, texture and shape, and should be hard, tough, evenly burned and thoroughly annealed. When broken the bricks should show a uniform fracture, free from lime, marked laminations and other defects which shall tend to depreciate their value as a paving material. Kiln-marks must not exceed three-sixteenths ($\frac{3}{16}$) of an inch in depth. If the edges of the brick are rounded the radius shall not exceed three-sixteenths ($\frac{3}{16}$) of an inch. They shall have one fairly straight face and be provided with not less than two (2) nor more than four (4) projections on one side of the brick, which shall not project more than one-fourth ($\frac{1}{4}$) of an inch nor less than one-eighth ($\frac{1}{8}$) of an inch.

Size

Section 25. The standard size of paving brick shall be three and one-half ($3\frac{1}{2}$) inches in width, four (4) inches in depth, and eight and one-half ($8\frac{1}{2}$) inches in length, and shall not vary from these dimensions more than one-eighth ($\frac{1}{8}$) of an inch in width or depth, nor more than one-half ($\frac{1}{2}$) of an inch in length. Bricks must not vary in width more than one-eighth ($\frac{1}{8}$) of an inch one from the other in any one shipment.

Section 26. The bricks shall not lose of their weight more than per cent, after being submitted to the Standard Rattler Test, to be made under the specifications in the manner and method and with a rattler together with the records thereof, as proposed by Committee C-3 of the American Society for Testing Materials at their annual meeting in 1913, as herein set forth. The permissible loss to be specified in any given district or municipality and for any given purpose is a matter wholly within the province of the buyer, and should be governed by the kind and amount of traffic to be carried, and the quality of paving bricks available.

Test Quality

Section 27. Paving brick shall not be judged for acceptance or rejection by the results of individual tests, but by the average of no less than five (5) tests. Where a lot of bricks fail to meet the required average, it shall be optional with the buyer whether the brick shall be definitely rejected or whether they may be regraded and a portion selected for further test as provided herein.

Basis of
Acceptance
or Rejection

Section 28. Some fluctuation in the results of the rattler test, both on account of variations in the bricks and in the machine used in testing are unavoidable and a reasonable allowance for such fluctuations should be made, wherever the standard may be fixed.

Range of
Fluctuation

Section 29. In any lot of paving brick, if the loss on a test computed upon its initial weight exceeds the standard loss by more than two (2) per cent then the portion of the lot represented by that test shall at once be resampled and three more tests executed upon it, and if any of these three tests shall again exceed by more than two (2) per cent of the required standard, then that portion of the lot shall be rejected.

Abrasion
Limitation

Section 30. If in any lot of brick, two (2) or more tests exceed the permissible maximum, then the buyer may at his option reject the entire lot, even though the average of all the tests executed may be within the required limits.

Buyer's
Option

Section 31. The percentage of loss which shall be taken as the standard is as follows:

Standards

General average loss_____	Maximum permissible loss_____
---------------------------------	-------------------------------------

**Culling and
Retesting**

Section 32. Where, under Sections 27 and 28 a lot or portion of a lot of brick is rejected, either by reason of a failure to show a low average test or because of tests above the permissible maximum, the buyer may at his option permit the seller to regrade the rejected brick, separating out that portion which he considers good. When the regrading is complete, the good portion shall be then resampled and retested, under the original conditions, and if it fails again either in average or in permissible maximum, then the buyer may definitely and finally reject the entire lot or portion under test.

**Payment of
Cost of
Testing**

Section 33. Unless otherwise specified, the cost of testing the material as delivered or prepared for delivery, up to the prescribed number of tests for valid acceptance or rejection of the lot, shall be paid by the buyer. (See also Section 37). The cost of testing extra samples made necessary by the failure of the whole lot or any portion of it, shall be paid by the seller, whether the material is finally accepted or not.

**Right of
the Buyer**

Section 34. It shall be the right of the buyer to inspect the bricks, subsequent to their delivery at the place of use, and prior to or during laying, to cull out and reject upon the following grounds:

**Broken or
Chipped
Brick**

Section 35. All bricks which are broken in two or chipped in such a manner that neither wearing surface remains substantially intact, or that the lower or bearing surface is reduced in area by more than one-fifth (1-5). Where brick are rejected upon this ground, it shall be the duty of the purchaser to use them so far as practicable in obtaining the necessary half bricks for breaking courses and making closures, instead of breaking otherwise whole and sound brick for this purpose.

**Character of
Disqualification**

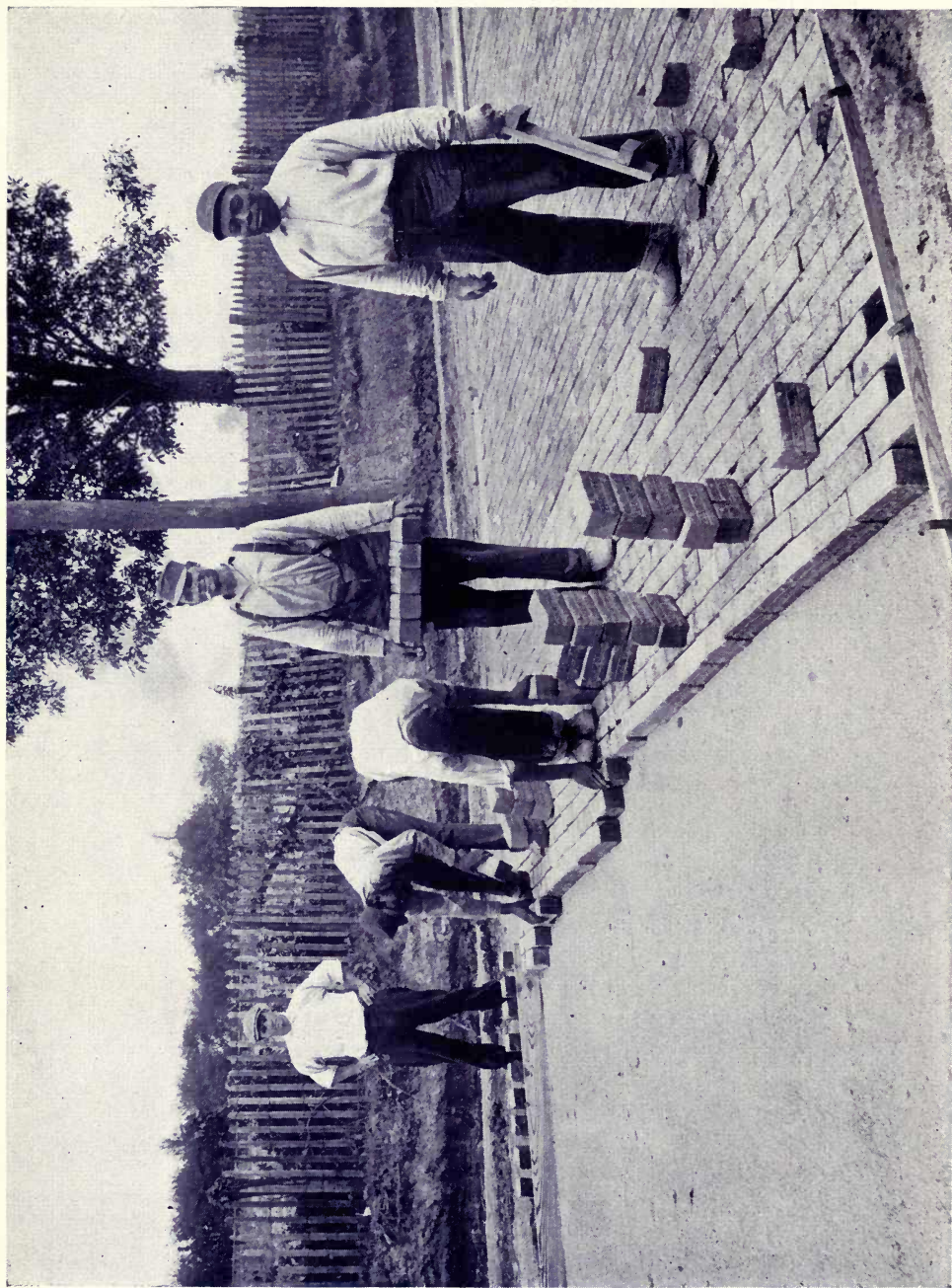
Section 36. All bricks which are cracked in such a degree as to produce defects such as defined in Section 35 either from shocks received in shipment and handling, or defective conditions of manufacture, especially in drying, burning or cooling, unless such cracks are plainly superficial and not such as to perceptibly weaken the resistance of the brick to its conditions of use. All bricks which are so off-size, or so misshapen, bent, twisted or kiln-marked, that they will not form a proper surface as defined by the paving specifications or align with other bricks without making joints other than those permitted in the paving specifications.

Section 37. All bricks which are obviously too soft and too poorly vitrified to endure street wear. When any disagreement arises between buyer and seller under this item, it shall be the right of the buyer to make two or more rattler tests of the brick which he wishes to exclude, and if in either or both tests, the bricks fall beyond the maximum rattler losses permitted under the specifications, then all bricks having the same objectionable appearance may be excluded, and the seller must pay for the cost of the test. But if under such procedure, the bricks which have been tested as objectionable, shall pass the rattler test, both tests falling within the permitted maximum, then the buyer cannot exclude the class of material represented by this test and he shall pay for the cost of the test.

BRICK LAYING and INSPECTION

Section 38. Before the grading is finished the bricks shall be hauled and neatly piled without the curb line in sufficient quantities to complete the brick surface. Clamps or conveyors may be used in connection with this work but the brick shall not be dumped from wagons nor shall they be thrown from wagons to piles or from cars to wagons, nor shall they be piled in any location where they are likely to become bespattered or covered with mud or otherwise injured unless thoroughly protected.

In delivering the bricks from the piles for placement in the streets, no wheeling in barrows will be allowed on the brick surface, but they should be carried on pallets, after they have been first placed on the pallets in such order that when delivered to the dropper, they will lie in such a position, that each brick in the regular operation of placing it upon the cushion as prepared, will bring the projections in the same direction and the best edge uppermost.



Brick Handling and Inspection—See Section 38

Upon the cushion as prepared the bricks shall be laid perpendicular with the best edge up, the projections in one direction, and with the courses straight and at right angles to the curb line. All joints must be broken at least three (3) inches. After the bricks are laid the end joints must be made close and immediately battled in at the curb line. At every fourth course or as often as directed the bricks are to be closed up and courses straightened by tapping lightly with a sledge on a four by four-inch timber three feet in length, provided for that purpose. Nothing but whole bricks shall be used except in starting and finishing courses, or in such case as may be specially directed by the engineer. The cutting and trimming of bricks shall be done by experienced men, and the fractured ends turned towards the center of the street. For closures nothing less than two and one-half (2½) inch bats shall be used. Broken and chipped bricks fit for batting shall be used as provided in Section 35. All bricks when laid shall be clean and kept clean and entirely free from dirt or other foreign matter until pavement is completed. All the work of brick laying shall be over the brick already laid. Tramping upon the cushion is prohibited. As soon as any surplus of delivery of brick is ascertained, they shall be promptly moved forward for use.

Section 39. After the brick have been laid, the chips shall be swept from the street, all soft brick removed or those badly broken, badly spawled or misshapen shall be turned over or removed by the contractor. Bricks slightly chipped on corners otherwise good, shall be accepted. All rejected brick suitable for batting in shall be carried forward and used for that purpose; the remainder shall be placed in separate piles along the street. The inspector shall keep the bricks culled and the contractor shall make the necessary changes and replacements so that the work at all times shall be ready for the grouting within one hundred (100) feet of the brick laying.

Preparation
for Rolling



Rolling Brick—See Sections 38-39 and 40

ROLLING

Section 40. After the bricks in the pavement have been inspected and the surface of the pavement swept clean, the pavement shall be rolled with a tandem self-propelling roller, weighing not less than three (3) nor more than five (5) tons, in the following manner: the rolling will commence near the curb at a slow pace and continue back and forth until the center of the pavement is reached, then pass to the opposite curb and repeat in the same manner to the center of the street. After the first passage of the roller the pace may be quickened. The pavement shall then be rolled transversely at an angle of forty-five (45) degrees to the curb, repeat the rolling in like manner in the opposite direction, then roll parallel with the curb until the surface is smooth.

**Manner of
Rolling**

Section 41. Before this last rolling takes place all broken or injured brick must be taken up and replaced with acceptable ones. Portions of the pavement inaccessible to the roller shall be tamped to grade by the use of a hand tamper applied upon a two-inch board. The joints should be inspected and if the cushion has been forced up between the bricks more than one-half ($\frac{1}{2}$) inch, they shall be re-laid and re-rolled.

**Examination
and Inspection**

Section 42. After the final rolling the surface shall be tested with a ten (10) foot straight edge laid parallel with the curb, and any depressions exceeding one-quarter ($\frac{1}{4}$) of an inch must be taken out.

**Testing
Condition of
the Work**

CEMENT GROUT FILLER

Proportions

Section 43. The cement grout used in filling the joints in the bricks shall consist of one (1) part of cement and one (1) part of sand.

Cement

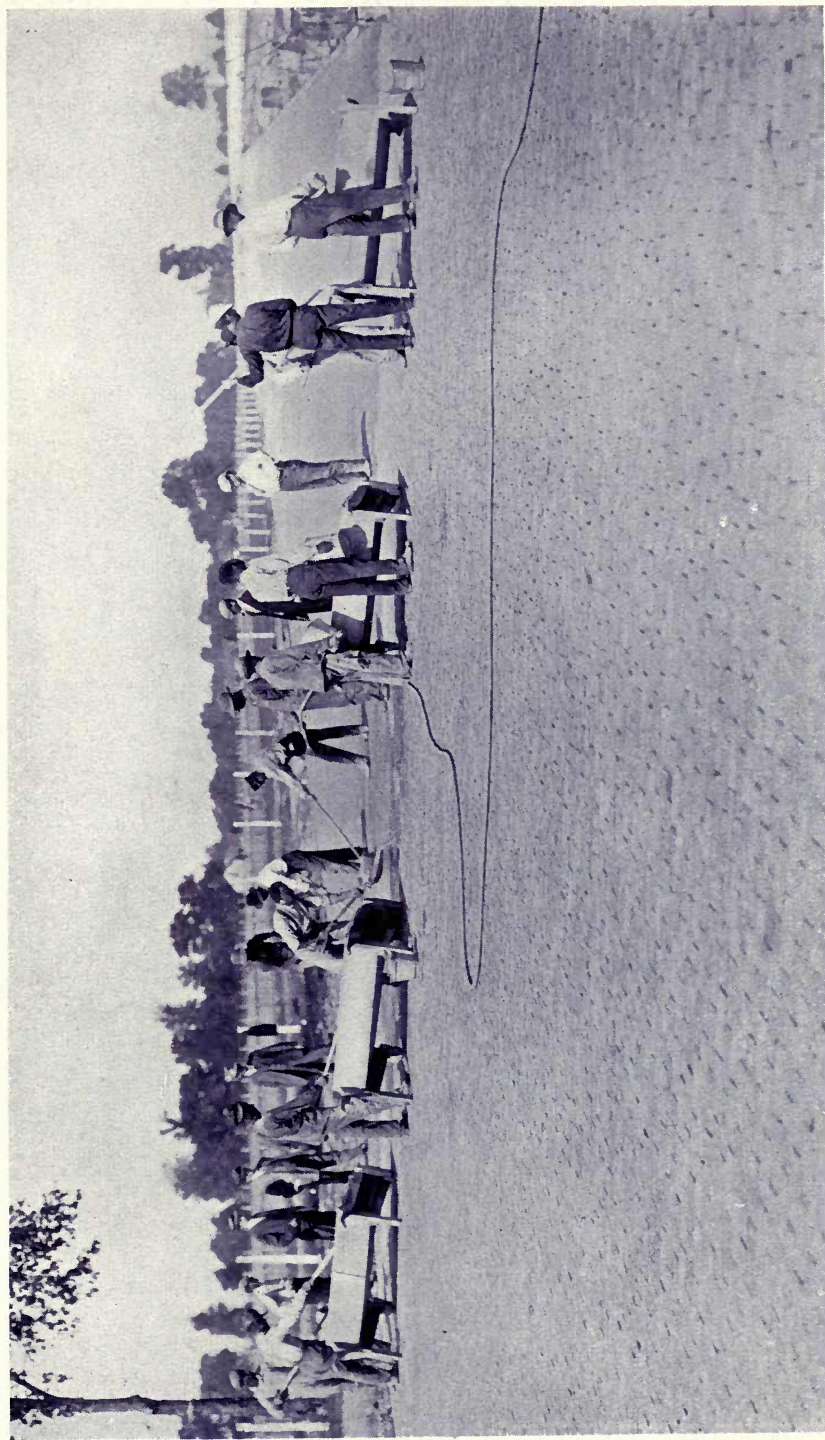
Section 44. The cement shall meet the requirements of the Standard Specifications for Portland cement of the American Society for Testing Materials, adopted August 15, 1909, with amendments and additions thereto adopted by said Society.

Sand

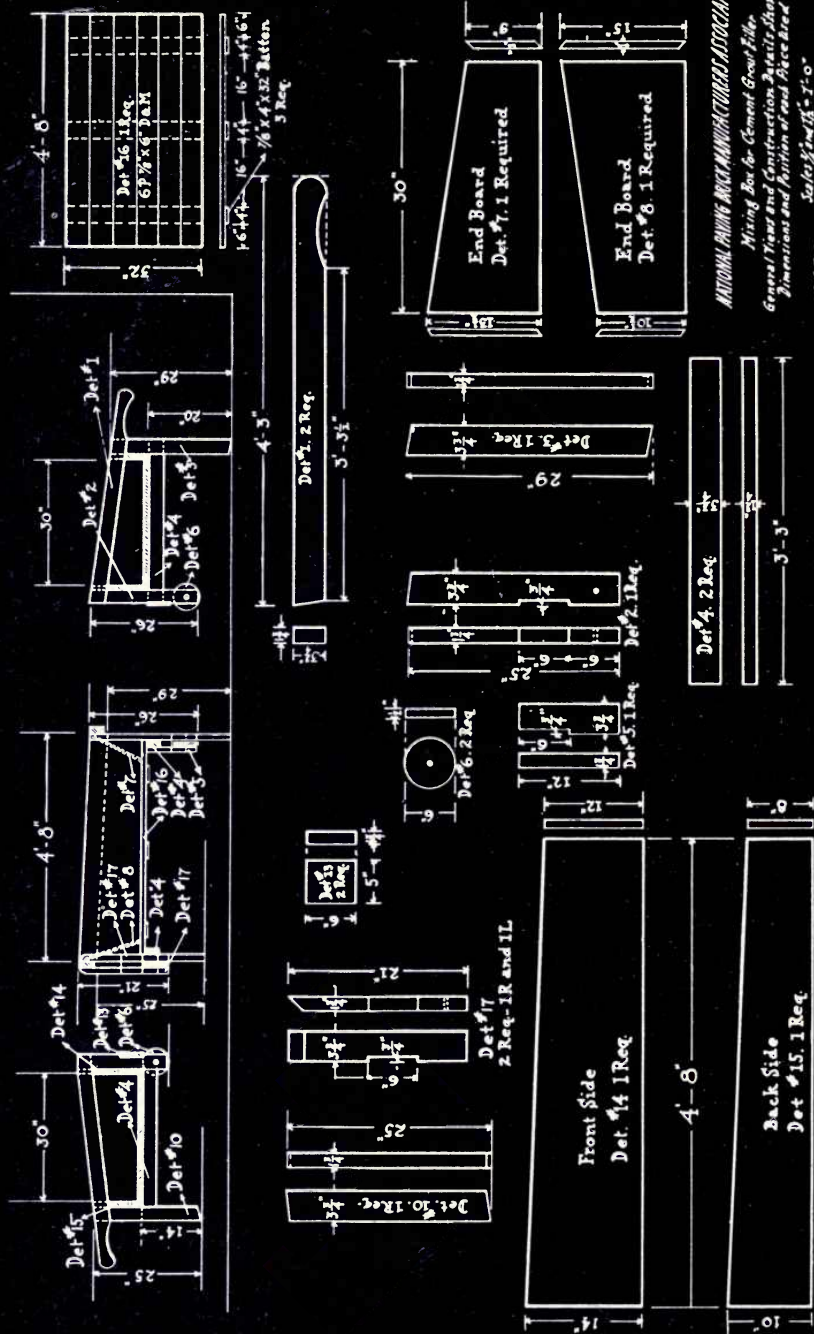
Section 45. The sand for the grout filler shall be composed of clean, sharp, well graded quartz grains and shall not contain more than one per cent, by weight, of clay or silt. The grains shall be such size that all will pass a No. 12 sieve and that not more than 40 per cent will pass a No. 50 sieve, and be approved by the engineer.

Filter Application

Section 46. Before the grout is applied the bricks should be thoroughly wet by sprinkling. After equal portions of the cement and sand have been thoroughly mixed until the mass assumes a uniform color, a small batch not exceeding two (2) cubic feet shall be placed in a suitable box* or a machine specially adapted for that purpose, by slowly adding water and thoroughly mixing until the mixture is of the consistency that would readily flow into the joints without separation. Ample time must be taken in preparing this liquid mixture, first making a plastic mortar, then gradually thinning by mixing and slowly adding water, continue the mixing until all is removed and applied to the surface in small quantities. The application should be continued until the joints appear to be filled. Any surplus material remaining on the bricks shall then be swept into the joints. Extreme care must be taken that the joints are not cemented over and that the filler extends down to the bottom of the brick. After the first coat has had a chance to settle and before the initial set develops, a second coat shall be applied in a similar manner with a somewhat thicker grout. After this application has had time to settle and before the initial set takes place, the pavement shall be finished to a smooth surface with a squeegee having a rubber edge which shall be worked over the brick at an angle with the joints, thus leaving them entirely filled. The manner of application and equipment to be used shall be approved by the engineer.



Construction of Brick Pavement—Applying the Filler—See Section 46



End Board
Det. #1 Required

End Board
Det. 8. 1 Required

NATIONAL PAYING BRICK MANUFACTURERS ASSOCIATION

Mixing Box for Cement Grout Filler

Scales $\frac{1}{4}$ inch $\frac{1}{16}$ " = 1'-0"

Detail Drawing for the Construction of Grout Box



The completed grout box as made from the drawing on the opposite page.
Note the "one lowest corner" as secured by legs of different lengths

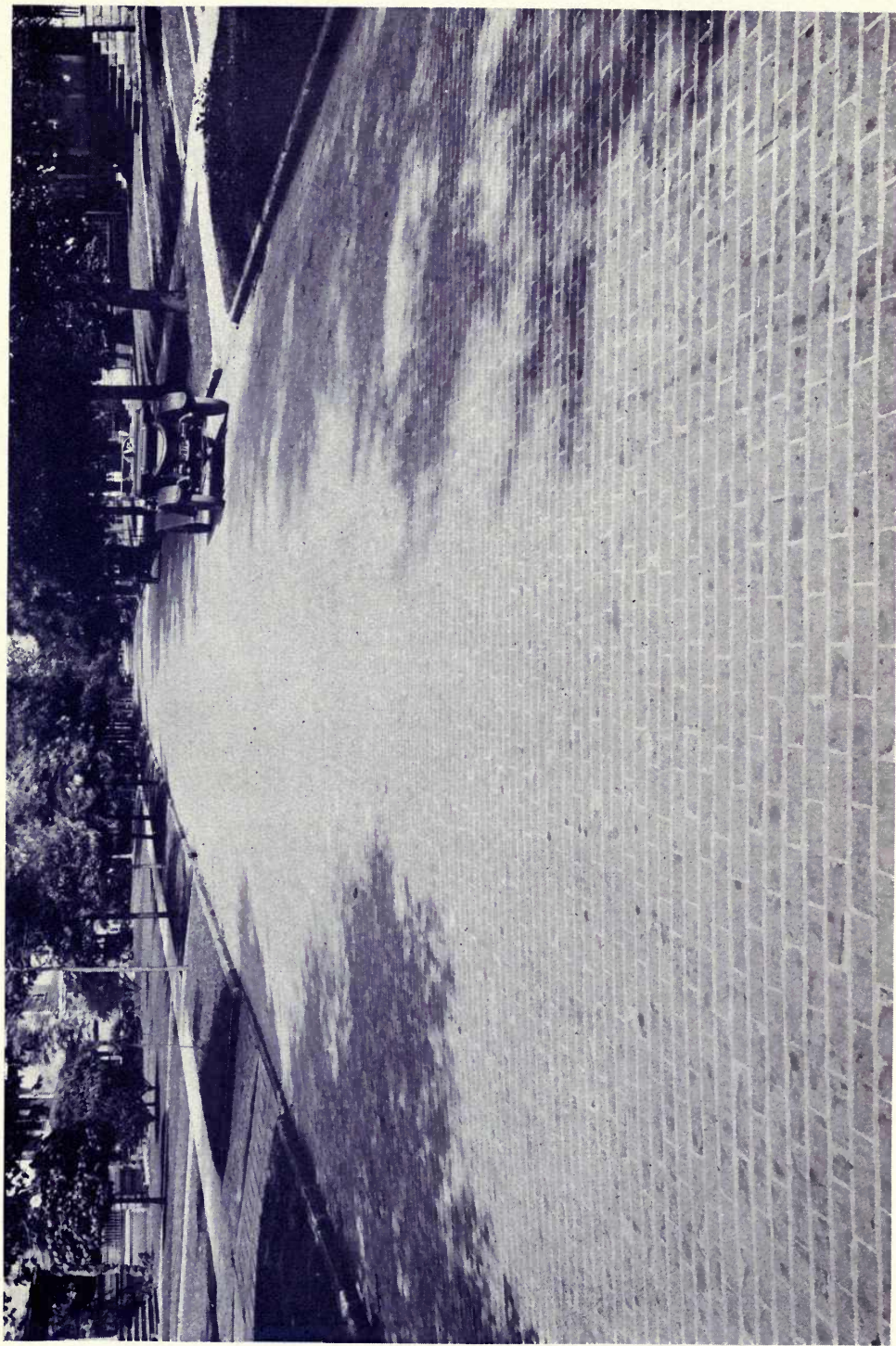
Section 47. The contractor must provide thin metal strips one-sixteenth (1-16) of an inch by six (6) inches by three (3) feet long and insert same in the brick joints across the street when closing up a stretch of grouting at work intervals, so that the grouting will end in a vertical joint. These strips must be taken out when the grout becomes stiff and before the initial set.

Work Intervals

Section 48. After the surface has been thoroughly inspected and if approved, and sufficient time for setting has taken place so that a coating of sand or earth will not absorb any moisture from the cement mixture, the surface shall be covered with a layer of one-half ($\frac{1}{2}$) inch or more of sand or earth to prevent too rapid drying of the filler. This shall be kept moist for at least four (4) days, and no traffic should be allowed on the street for a period of at least eight (8) days, or longer, as the engineer may require on account of weather conditions.

Protection for Setting

* Note: Box recommended by the National Paving Brick Manufacturers Association.



A typical city street of modern construction. Eight years old at the time the photograph was taken.
Sanitary smooth durable and beautiful

ALTERNATIVES CONCRETE CURBING

If concrete curbing is to be used, eliminate Sections 6 and 7 and substitute the following:

The concrete for the curb shall be composed of the kind of aggregate specified herein for the base. It shall be thoroughly mixed in a batch mixer and so proportioned that cubic feet of the concrete in place shall contain ninety-four (94) pounds of cement. The concrete shall be set true between the forms which have heretofore been set true to grade and alignment and held securely in place by stakes and clamps. The concrete shall be tamped with a spade until the mortar flushes against the form and to the surface. The upper surface, exposed sides and edges of the curb shall then be finished by scouring with a wood float. The curb shall, upon completion, be kept covered for not less than days, to prevent too rapid drying.

CONCRETE FILLED BRICK PAVEMENT WITHOUT CURBS WITH COMBINED FOUNDATION AND EDGING TO PROTECT AND HOLD THE SAND FILLER, AN ADAP- TATION PARTICULARLY SUITABLE FOR PARKWAYS AND COUNTRY HIGHWAYS

The concrete foundation shall be constructed three (3) inches wider than the brick wearing surface and upon either edge of the foundation shall be built an edging of one and one-half ($1\frac{1}{2}$) inches by one and one-half ($1\frac{1}{2}$) inches. This edging shall be built immediately following the spreading of the foundation proper in suitable forms and tamped in sufficiently to form a perfect adhesion with the foundation.

CEMENT FILLED BRICK PAVE- MENT—Eliminating the Curb

Upon the foundation and cushion, shall be laid a brick pavement constructed as hereinbefore specified for the laying of brick pavements, except that the forms (instead of curbs) to be used shall be two inch planks, of the depth necessary to cover the depth of the pavement as specified, and shall be set firmly to grade and made rigid by staking and bracing. The bricks in the road-pavement shall be so laid that all fractured ends of the way shall be laid as above specified. The edge of the blocks or bricks shall be laid toward the center of the pavement, leaving the edge finished and true to line, and that no bats shall be used smaller than one-half a

brick, the end of the adjoining brick shall be broken off to accomplish this result. In all cases this pavement shall be finished with a cement filler, as hereinbefore set forth in these specifications.

After the pavement is completed, and the cement filler has set up sufficiently, the form boards shall be removed and the space filled in with the natural earth, thoroughly compacted; or, if a stone or gravel shoulder is provided in the specifications, the filling material shall be thoroughly rolled and compacted so as to conform to the cross-section of the roadway.

CRUSHED STONE FOUNDATION

If crushed stone foundation is to be used, substitute the following for Sections 10 to 20 inclusive:

Upon the sub-grade formed and compacted there shall be spread a foundation of clean crushed stone, of good quality, and of sufficient quantity, that after being bonded with enough screenings to fill all interstices and sufficiently flooded with water to allow of its being thoroughly compacted, and rolled with a three-wheeled self-propelling roller of not less than ten (10) tons in weight shall measure inches in depth. The top surface of this foundation shall be parallel with and at an elevation of inches below the finished arc of the pavement. The stone shall be practically uniform in quality and shall be crushed and screened so as to pass through a screen with openings inches in diameter, and be retained on a screen with openings one (1) inch in diameter—said foundation shall be laid, bonded and rolled in courses—the bottom course inches in depth and the top course inches in depth. After the limestone screenings are spread upon the stone, each course shall be rolled dry at least twice before water is applied.

OLD GRAVEL OR MACADAM FOUNDATION

If old gravel or macadam foundation is to be used, substitute the following in place of Sections 10 to 20 inclusive:

The present macadam or gravel foundation shall be cleaned of all earth and refuse and shall be scarified to such a depth as when graded to a true cross-section it shall have loose material over its entire surface to a

depth of not less than two (2) inches. The surface of this roadway shall be built up with loose stone to such a depth as when rolled it will assume a cross-section of the finished foundation. The material used in building up the old roadway shall be crushed stone or gravel that will pass a one (1) inch screen and be retained on a one-fourth ($\frac{1}{4}$) inch screen and covered with enough screenings to fill all the interstices and sufficiently flooded with water to allow it to be thoroughly compacted, then rolled with a three wheeled self-propelling roller not less than ten (10) tons in weight. The surface shall present a thoroughly bonded and filled cross-section so as to prevent the cushion from sifting through it.

No. 2 PAVING BRICK FOUNDATION

If No. 2 paving brick foundation is to be used, substitute the following in place of Sections 10 to 20 inclusive:

Upon the sub-grade as heretofore specified shall be spread a base of sand two (2) inches in thickness which shall be brought to a perfect grade, conforming to that of the finished pavement. There shall be laid flatwise, parallel with the street, upon this grade thus prepared, a layer of No. 2 paving brick, the interstices of which shall be filled with sand. The brick shall be rolled as provided in Section 40.

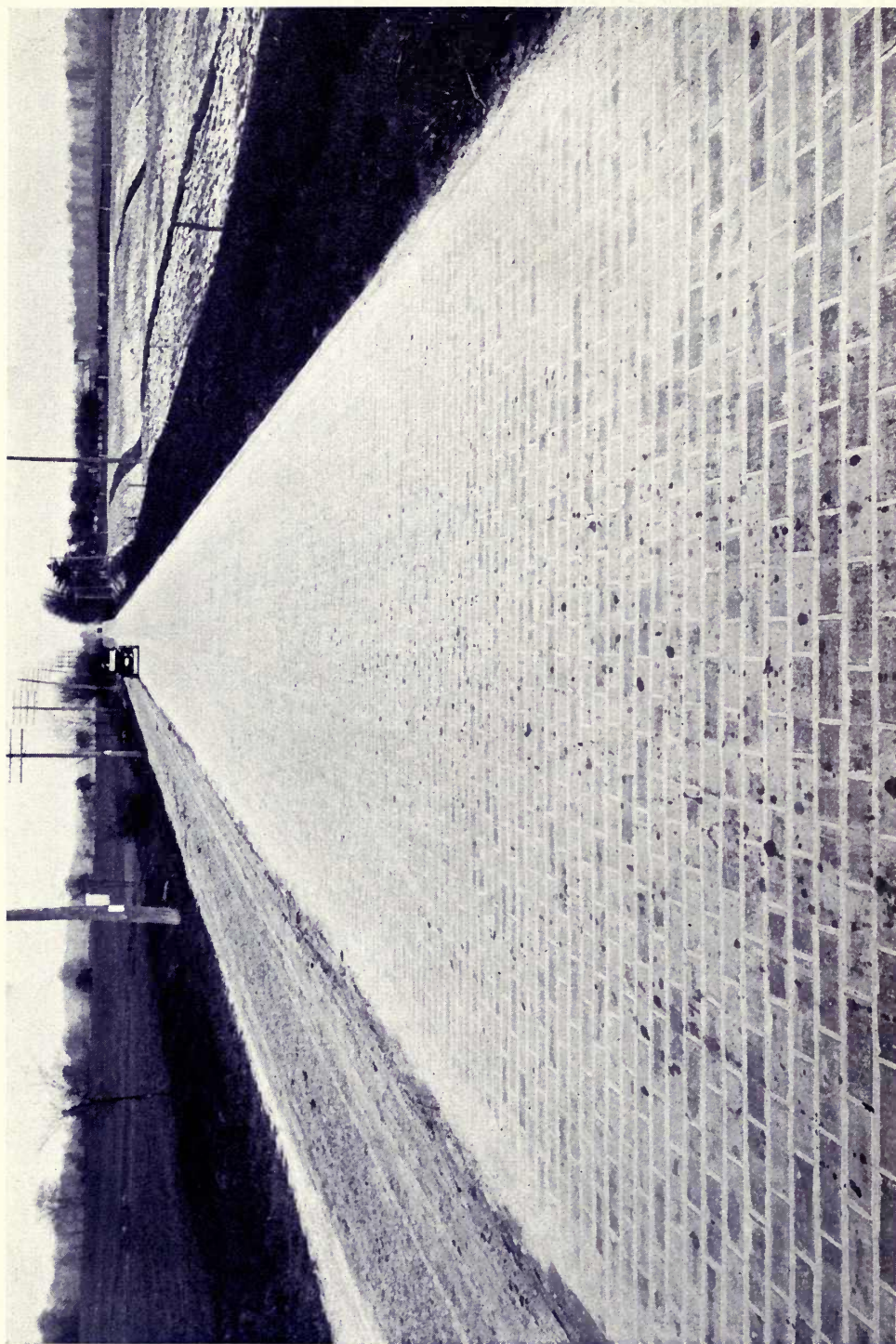
BRICK PAVEMENT ON NATURAL EARTH WITHOUT AN ARTIFICIAL FOUNDATION

In the construction of such a pavement, eliminate Sections 10 to 20 inclusive.

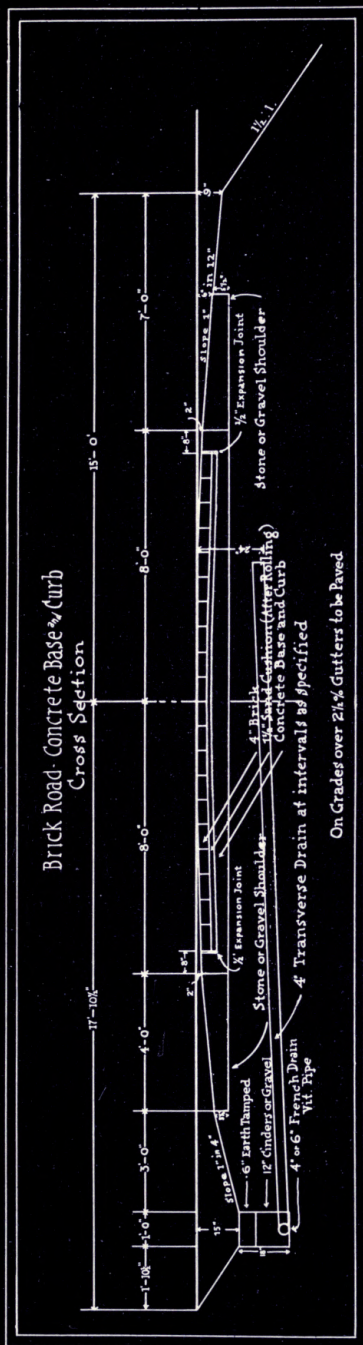
SAND FILLER

If sand filler is to be used instead of cement filler, eliminate Sections 43 to 47 inclusive and substitute the following:

All of the interstices between the bricks shall be completely filled with clean, fine dry sand, which shall be spread upon the surface of the brick to the thickness of one-half ($\frac{1}{2}$) inch, over which shall be drawn a sweeper, roller or brush. This should be repeatedly gone over and additional sand added, until the interstices are completely filled and a surplus of one-quarter ($\frac{1}{4}$) of an inch of sand remaining on top.



The durable and economic market road. Akron-Cleveland thoroughfare



THIS diagram of Cross Section suggests a too often overlooked but one of the most important features of street or road construction—Drainage. The drainage design should be placed according to local conditions to secure a dry sub-base. Side open tile drains to carry off the water are always in working order even if the open ditchides should become stopped up. The sloping of the berms where possible make easy mowing, less washing and favor a better grass lawn.

Specifications *for the* Construction of Vitrified Brick Highways

GRADING

Section 1. The road bed will be considered as that portion of the road upon which the base of the brick roadway and edging is laid and also that portion of the roadway upon which the crushed stone shoulders or berms and side roads are to be constructed. All of which is to be improved including the approaches thereto, and graded and drained to such grades, sub-grades and cross-sections as are shown by the plans of the engineer.

Section 2. Earth in excavation shall be removed with plow and scraper or other device to such a depth as when rolled will conform to the true sub-grade. (The roller for this purpose should be three wheeled, self-propelling and should weigh not less than six nor more than ten tons.) Excess of material from excavations beyond that which is necessary to be used in embankment may be wasted in widening the roadway.

Section 3. Earth in embankment must be applied in layers not more than six (6) inches in thickness, and each layer shall extend entirely across from the toe of the slope on one side to the toe of the slope on the other side, and each layer shall be thoroughly rolled; all spongy and soft earth that cannot be made firm by rolling shall be removed and replaced with suitable material. Careful attention should be given to bring the entire sub-grade to a uniform density.

If insufficient material for embankment is obtained from the section of the roadway where materials must be excavated, then additional material for embankment will be secured from borrow pits the location of which is shown on plans.

Section 4. After the roadbed or foundation has been completed ready for the pavement, no loaded or empty wagons or other vehicles that might disturb the finished surface shall be permitted thereon, unless the surface is properly protected.

Earth in
Excavation

Earth in
Embankment

Protection of
Sub-Grade

DRAINAGE

Section 5. Drainage should be provided sufficient to rapidly remove all water from the roadway to a depth of not less than eighteen (18) inches below its finished surface.

Drainage

CONCRETE EDGING

Section 6. At either edge of the brick work shall be placed an edging inches in thickness and inches in depth.

Concrete
Edging

Section 7. The concrete for the edging shall be composed of the kind of aggregate specified herein for the base. It shall be thoroughly mixed in a batch mixer and so proportioned that cubic feet of the concrete in place shall contain ninety-four (94) pounds of cement. The concrete shall be placed between the forms which have heretofore been set true to grade and alignment and held securely in place by stakes and clamps. The concrete shall be tamped until the mortar flushes against the form and to the surface. The upper surface of the edging shall then be finished by scouring with a wood float. The edging shall, upon completion, be kept covered for not less than days to prevent too rapid drying.

Composition

Section 8. During or after the construction of the road bed, earth side roads and berms shall be constructed. They shall be made true to the alignment and cross-section shown on the plans. The earth side roads shall be thoroughly rolled. No material containing weeds, roots or decomposed vegetable matter shall be used in the construction of the earth side roads. If macadam shoulders are provided on the plans, the earth side roads shall be rolled before or during the rolling of the macadam shoulders.

Section 9. In filling hillside embankments where the fill exceeds two feet the surface should be thoroughly broken up and steeped. No material containing roots, stumps or decomposed vegetable matter shall be used in the construction of any part of the road bed or allowed to remain within two (2) feet of the surface thereof.

CONCRETE FOUNDATION

Cement

Section 10. Cement used in the work shall meet the requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials, adopted August 16, 1909, with amendments and additions thereto adopted by said Society.

Water

Section 11. Water used in mixing the concrete shall be clean, free from oil, acid, strong alkalies or vegetable matter.

Fine Aggregate

Section 12. Fine aggregate shall consist of screenings from hard durable sand, gravel, granite or other hard rock and must not contain more than five (5) per cent of clay. It shall be reasonably uniformly graded from a size which will pass through a one-fourth ($\frac{1}{4}$) inch screen down. Sand containing disintegrated shale or slate shall not be used.

Coarse Aggregate

Section 13. Coarse aggregate shall consist of sound gravel, stone, vitrified clay or slag. It shall be free from all foreign matter, uniformly graded, and shall range in size from one-fourth ($\frac{1}{4}$) inch up to that which will pass a one and one-half ($1\frac{1}{2}$) inch revolving screen.

Concrete Proportions

Section 14. The cement and aggregate shall be measured separately and then mixed in such proportions that the resulting concrete shall contain fine aggregate amounting to one-half ($\frac{1}{2}$) of the volume of the coarse aggregate, and that cubic feet of the concrete in place will contain ninety-four (94) pounds of cement.

Mixing

Section 15. The ingredients of the concrete shall be thoroughly mixed, sufficient water being added to obtain the desired consistency, and the mixing continued until the materials are uniformly distributed, and each particle of the fine aggregate is thoroughly coated with cement and each particle of coarse aggregate is thoroughly coated with mortar. A batch concrete mixer must be used, the materials must be proportioned dry, and then deposited in the mixer all at the same time. The mixer must produce a concrete of uniform consistency and color, with the stones thoroughly mixed with the water, sand and cement.

Section 16. The materials shall be mixed wet enough to produce a concrete of a consistency which can be handled without causing a separation of the coarse aggregate from the mortar while being spread into position with a template, straight edge or back of a shovel.

Consistency

Section 17. Retempering, that is, remixing with additional water, mortar or concrete that has partially hardened, shall not be permitted. No concrete shall be mixed while the air temperature is below 32 degrees F. except with the consent of the engineer.

Precautionary Measures

Section 18. The concrete shall be deposited in a layer on the sub-grade in such quantities that it will be of the required thickness and the upper surface shall be smooth, true, uniform and parallel with the surface of the finished pavement and must not exceed a limit of one-half ($\frac{1}{2}$) inch from the true surface. In conveying the concrete from the place of mixing to the place of deposit, the operation must be conducted in such a manner that no mortar will be lost and the concrete must be so handled that the foundation will be of uniform composition throughout, showing no excess or lack of mortar in any place. If the sub-grade is exceedingly dry it shall be moistened.

Placing Concrete

Section 19. This foundation shall be inches in thickness, with its upper surface finished to inches below the grade of the finished pavement.

Thickness

Section 20. When complete, the foundation shall be kept moist for not less than two (2) days. No loaded or empty wagons or other vehicles that might disturb the finished surface shall be permitted thereon, unless the surface is properly protected.

Protection

CUSHION

Section 21. Upon the foundation shall be spread a cushion which will be one and one-half ($1\frac{1}{2}$) inches in depth after the same has been thoroughly and firmly compacted by rolling. The material for this cushion shall consist of granulated slag, stone dust, or a loamy sand which will firmly compact by rolling and must pass a quarter ($\frac{1}{4}$) inch screen.

Character of Material

Section 22. The cushion must be carefully shaped to a true cross-section, parallel with the finished roadway, by means of a template covering at least one-half ($\frac{1}{2}$) of the width of the brick work, and so made as to be easily drawn over the curb or guide rail. Guide timbers shall be one and one-half ($1\frac{1}{2}$) inches by four (4) inches, and not less than fourteen (14) feet in length, and laid to a true line parallel with the grade in the center of the street and next to the curb (if top of curb cannot be used). Before shaping the cushion, a one-half ($\frac{1}{2}$) inch strip shall be laid on the curb or guide rail and strip of same thickness laid on guide timbers in the center of street, and a template drawn over the same leaving the cushion complete in place one-half ($\frac{1}{2}$) inch above the surface required, after which the one-half ($\frac{1}{2}$) inch strip shall be removed and the surface rolled thoroughly with a hand roller. After rolling, the template shall be drawn over the curb and guide timbers to complete the cushion. If the cushion should not be uniformly compacted and parallel to the surface of the finished pavement, the operations shall be repeated. The operations of shaping the foundation for the pavement and of compressing and shaping the cushion for the brick are considered of prime importance in securing the desired evenness in the surface of the finished pavement, and the contractor will be required to equip himself with the proper implements approved by the engineer and to secure skilled men for this part of the work. The roller for rolling the cushion shall weigh not less than ten (10) pounds per inch in length and should be approximately twenty-four (24) inches in diameter and not more than thirty (30) inches in length and may be in sections.

EXPANSION JOINTS

Section 23. Expansion joints shall be placed parallel with and at each curb line and extend across each street and alley intersection. It should be one-half ($\frac{1}{2}$) of an inch in width for streets less than twenty (20) feet wide; three-fourths ($\frac{3}{4}$) of an inch for streets from twenty (20) to thirty (30) feet wide and one (1) inch in width for streets wider than thirty (30) feet. This joint must extend to the depth of the brick. No transverse joints shall be allowed. A prepared bituminous material that will remain pliable at all temperatures to which it may be subjected as a street paving filler shall be used for this purpose. The material should be made into strips of suitable length and of the required depth and thickness and should be laid in the pavement with the ends closely joined as the bricks are being laid.

BRICK

Section 24. The contractor must submit samples and name the brand of brick with prices respectively upon which he submits bids. The brick must be of the quality and size commercially known as vitrified paving block. They should be reasonably straight, uniform in size, texture and shape, and should be hard, tough, evenly burned and thoroughly annealed. When broken the bricks should show a uniform fracture, free from lime, marked laminations and other defects which shall tend to depreciate their value as a paving material. Kiln-marks must not exceed three-sixteenths ($\frac{3}{16}$) of an inch in depth. If the edges of the brick are rounded the radius shall not exceed three-sixteenths ($\frac{3}{16}$) of an inch. They shall have one fairly straight face and be provided with not less than two (2) nor more than four (4) projections on one side of the brick, which shall not project more than one-fourth ($\frac{1}{4}$) of an inch nor less than one-eighth ($\frac{1}{8}$) of an inch.

**Quality and
Character**

Section 25. The standard size of paving brick shall be three and one-half ($3\frac{1}{2}$) inches in width, four (4) inches in depth, and eight and one-half ($8\frac{1}{2}$) inches in length, and shall not vary from these dimensions more than one-eighth ($\frac{1}{8}$) of an inch in width or depth, nor more than one-half ($\frac{1}{2}$) of an inch in length. Bricks must not vary in width more than one-eighth ($\frac{1}{8}$) of an inch one from the other in any one shipment.

Size

Section 26. The bricks shall not lose of their weight more than per cent, after being submitted to the Standard Rattler Test, to be made under the specifications in the manner and method and with a rattler together with the records thereof, as proposed by Committee C-3 of the American Society for Testing Materials at their annual meeting in 1913, as herein set forth. The permissible loss to be specified in any given district or municipality and for any given purpose is a matter wholly within the province of the buyer, and should be governed by the kind and amount of traffic to be carried, and the quality of paving bricks available.

Test Quality

Section 27. Paving brick shall not be judged for acceptance or rejection by the results of individual tests, but by the average of no less than five (5) tests. Where a lot of bricks fail to meet the required average, it shall be optional with the buyer whether the brick shall be definitely rejected or whether they may be regraded and a portion selected for further test as provided herein.

**Basis of
Acceptance or
Rejection**

**Range of
Fluctuation**

Section 28. Some fluctuation in the results of the rattler test, both on account of variations in the bricks and in the machine used in testing are unavoidable and a reasonable allowance for such fluctuations should be made, wherever the standard may be fixed.

**Abrasion
Limitation**

Section 29. In any lot of paving brick, if the loss on a test computed upon its initial weight exceeds the standard loss by more than two (2) per cent then the portion of the lot represented by that test shall at once be resampled and three more tests executed upon it, and if any of these three tests shall again exceed by more than two (2) per cent of the required standard, then that portion of the lot shall be rejected.

**Buyer's
Option**

Section 30. If in any lot of brick, two (2) or more tests exceed the permissible maximum, then the buyer may at his option reject the entire lot, even though the average of all the tests executed may be within the required limits.

Standards

Section 31. The percentage of loss which shall be taken as the standard is as follows:

General average loss_____	Maximum permissible loss_____
---------------------------------	-------------------------------------

**Culling and
Retesting**

Section 32. Where, under Sections 27 and 28 a lot or portion of a lot of brick is rejected, either by reason of a failure to show a low average test or because of tests above the permissible maximum, the buyer may at his option permit the seller to regrade the rejected brick, separating out that portion which he considers good. When the regrading is complete, the good portion shall be then resampled and retested, under the original conditions, and if it fails again either in average or in permissible maximum, then the buyer may definitely and finally reject the entire lot or portion under test.

**Payment of
Cost of
Testing**

Section 33. Unless otherwise specified, the cost of testing the material as delivered or prepared for delivery, up to the prescribed number of tests for valid acceptance or rejection of the lot, shall be paid by the buyer. (See also Section 37.) The cost of testing extra samples made necessary by the failure of the whole lot or any portion of it, shall be paid by the seller, whether the material is finally accepted or not.

**Right of
the Buyer**

Section 34. It shall be the right of the buyer to inspect the bricks, subsequent to their delivery at the place of use, and prior to or during laying, to cull out and reject upon the following grounds:

Section 35. All bricks which are broken in two or chipped in such a manner that neither wearing surface remains substantially intact, or that the lower or bearing surface is reduced in area by more than one-fifth (1-5). Where brick are rejected upon this ground, it shall be the duty of the purchaser to use them so far as practicable in obtaining the necessary half bricks for breaking courses and making closures, instead of breaking otherwise whole and sound brick for this purpose.

Broken or
Chipped
Brick

Section 36. All bricks which are cracked in such a degree as to produce defects such as defined in Section 35 either from shocks received in shipment and handling, or defective conditions of manufacture, especially in drying, burning or cooling, unless such cracks are plainly superficial and not such as to perceptibly weaken the resistance of the brick to its conditions of use. All bricks which are so off-size or so misshapen, bent, twisted or kiln-marked, that they will not form a proper surface as defined by the paving specifications or align with other bricks without making joints other than those permitted in the paving specifications.

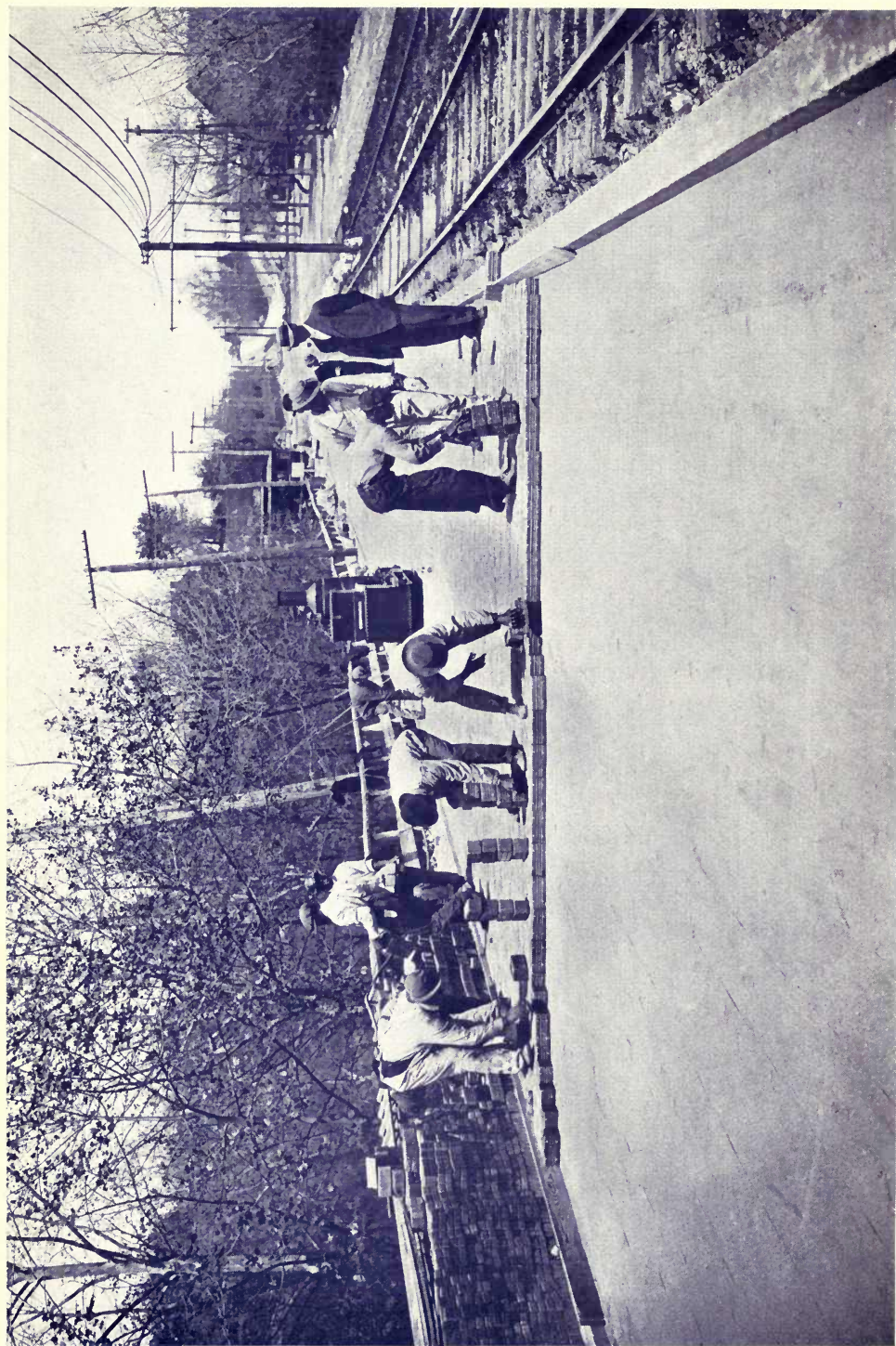
Character of
Disqualification

Section 37. All bricks which are obviously too soft and too poorly vitrified to endure street wear. When any disagreement arises between buyer and seller under this item, it shall be the right of the buyer to make two or more rattler tests of the brick which he wishes to exclude, and if in either or both tests, the bricks fall beyond the maximum rattler losses permitted under the specifications, then all bricks having the same objectionable appearance may be excluded, and the seller must pay for the cost of the test. But if under such procedure, the bricks which have been tested as objectionable, shall pass the rattler test, both tests falling within the permitted maximum, then the buyer cannot exclude the class of material represented by this test and he shall pay for the cost of the test.

Partial
Acceptance or
Rejection

BRICK LAYING and INSPECTION

Section 38. Before the grading is finished the bricks shall be hauled and neatly piled without the edging line in sufficient quantities to complete the brick surface. Clamps or conveyors may be used in connection with this work but the brick shall not be dumped from wagons nor shall they be thrown from wagons to piles or from cars to wagons, nor shall they be piled in any location where they are likely to become bespattered or covered with mud or otherwise injured unless thoroughly protected.



Brick Laying and Inspection—See Section 38

In delivering the bricks from the piles for placement in the streets, no wheeling in barrows will be allowed on the brick surface, but they should be carried on pallets, after they have been first placed on the pallets in such order that when delivered to the dropper, they will lie in such a position that each brick in the regular operation of placing it upon the cushion as prepared, will bring the projections in the same direction and the best edge uppermost.

Upon the cushion as prepared the bricks shall be laid perpendicular with the best edge up, the projections in one direction, and with the courses straight and at right angles to the edging line. All joints must be broken at least three (3) inches. After the bricks are laid the end joints must be made close and immediately battled in at the edging line. At every fourth course or as often as directed the bricks are to be closed up and courses straightened by tapping lightly with a sledge on a four by four inch timber three feet in length, provided for that purpose. Nothing but whole bricks shall be used except in starting and finishing courses, or in such case as may be specially directed by the engineer. The cutting and trimming of bricks shall be done by experienced men, and the fractured ends turned towards the center of the roadway. For closures nothing less than two and one-half (2½) inch bats shall be used. Broken and chipped bricks fit for batting shall be used as provided in Section 35. All bricks when laid shall be clean and kept clean and entirely free from dirt or other foreign matter until pavement is completed. All the work of brick laying shall be over the brick already laid. Tramping upon the cushion is prohibited. As soon as any surplus of delivery of brick is ascertained, they shall be promptly moved forward for use.

Section 39. After the brick have been laid, the chips shall be swept from the roadway, all soft brick removed or those badly broken, badly spawled or misshapen shall be turned over or removed by the contractor. Bricks slightly chipped on corners otherwise good, shall be accepted. All rejected brick suitable for batting in shall be carried forward and used for that purpose; the remainder shall be placed in separate piles along the street. The inspector shall keep the bricks culled and the contractor shall make the necessary changes and replacements so that the work at all times shall be ready for the grouting within one hundred (100) feet of the brick laying.

**Preparation
for Rolling**

ROLLING

Manner of Rolling

Section 40. After the bricks in the pavement have been inspected and the surface of the pavement swept clean, the pavement shall be rolled with a tandem self-propelling roller, weighing not less than three (3) nor more than five (5) tons, in the following manner: the rolling will commence near the edging at a slow pace and continue back and forth until the center of the pavement is reached, then pass to the opposite edge and repeat in the same manner to the center of the street. After the first passage of the roller the pace may be quickened. The pavement shall then be rolled transversely at an angle of forty-five (45) degrees to the edge, repeat the rolling in like manner in the opposite direction, then roll parallel with the edge until the surface is smooth.

Examination and Inspection

Section 41. Before this last rolling takes place all broken or injured brick must be taken up and replaced with acceptable ones. Portions of the pavement inaccessible to the roller shall be tamped to grade by the use of a hand tamper applied upon a two-inch board. The joints should be inspected and if the cushion has been forced up between the bricks more than one-half ($\frac{1}{2}$) inch, they shall be re-laid and re-rolled.

Testing Condition of the Work

Section 42. After the final rolling the surface shall be tested with a ten (10) foot straight edge laid parallel with the edging, and any depressions exceeding one-quarter ($\frac{1}{4}$) of an inch must be taken out.

CEMENT GROUT FILLER

Proportions

Section 43. The cement grout used in filling the joints in the bricks shall consist of one (1) part of cement and one (1) part of sand.

Cement

Section 44. The cement shall meet the requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials, adopted August 15, 1909, with amendments and additions thereto adopted by said Society.

Sand

Section 45. The sand for the grout filler shall be composed of clean, sharp, well graded quartz grains and shall not contain more than one per cent, by weight, of clay or silt. The grains shall be such size that all will pass a No. 12 sieve and that not more than 40 per cent will pass a No. 50 sieve, and be approved by the engineer.

Section 46. Before the grout is applied the bricks should be thoroughly wet by sprinkling. After equal portions of the cement and sand have been thoroughly mixed until the mass assumes a uniform color, a small batch not exceeding two (2) cubic feet shall be placed in a suitable box* or a machine specially adapted for that purpose, by slowly adding water and thoroughly mixing until the mixture is of the consistency that would readily flow into the joints without separation. Ample time must be taken in preparing this liquid mixture, first making a plastic mortar, then gradually thinning by mixing, and slowly adding water, continue the mixing until all is removed and applied to the surface in small quantities. The application should be continued until the joints appear to be filled. Any surplus material remaining on the bricks shall then be swept into the joints. Extreme care must be taken that the joints are not cemented over and that the filler extends down to the bottom of the brick. After the first coat has had a chance to settle and before the initial set develops, a second coat shall be applied in a similar manner with a somewhat thicker grout. After this application has had time to settle and before the initial set takes place, the pavement shall be finished to a smooth surface with a squeegee having a rubber edge which shall be worked over the brick at an angle with the joints, thus leaving them entirely filled. The manner of application and equipment to be used shall be approved by the engineer.

**Filler
Application**

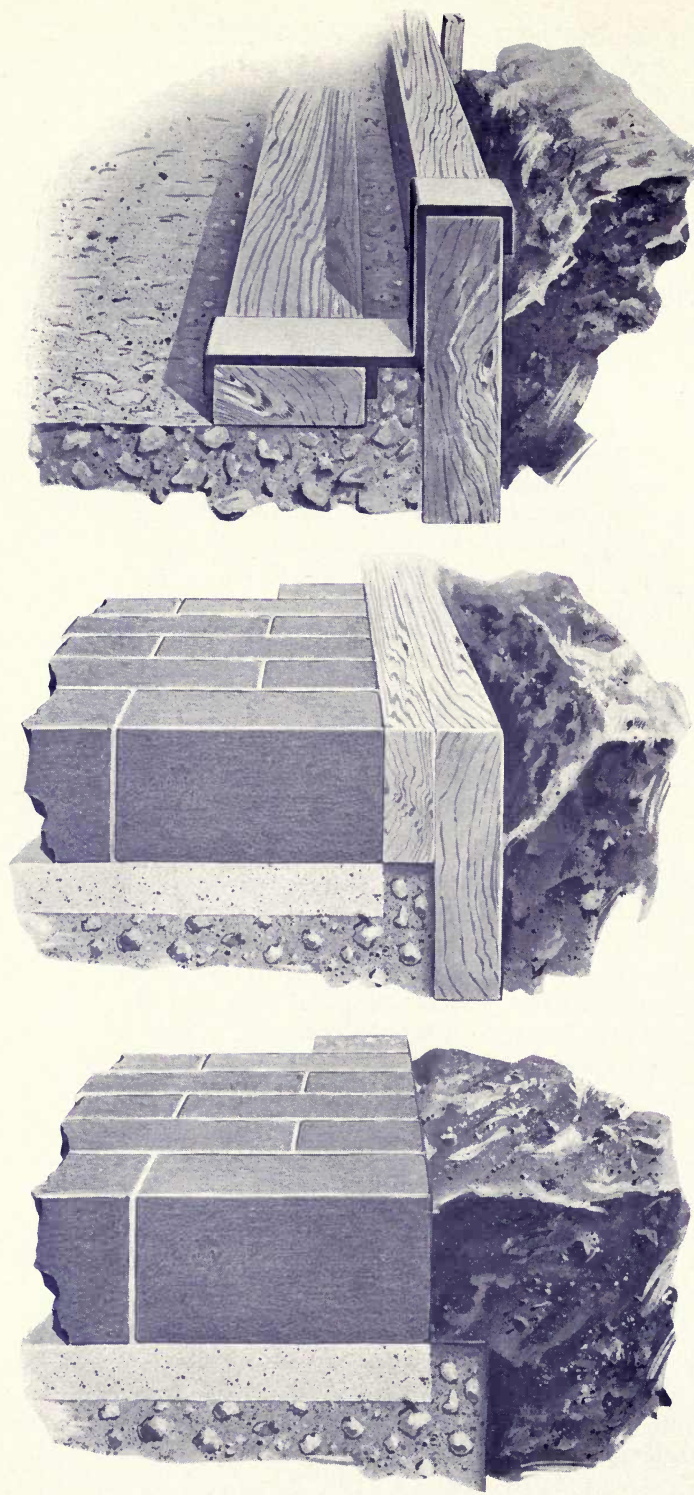
Section 47. The contractor must provide thin metal strips one-sixteenth ($\frac{1}{16}$) of an inch by six (6) inches by three (3) feet long and insert same in the brick joints across the roadway when closing up a stretch of grouting at work intervals, so that the grouting will end in a vertical joint. These strips must be taken out when the grout becomes stiff and before the initial set.

**Work
Intervals**

Section 48. After the surface has been thoroughly inspected and if approved, and sufficient time for setting has taken place so that a coating of sand or earth will not absorb any moisture from the cement mixture, the surface shall be covered with a layer of one-half ($\frac{1}{2}$) inch or more of sand or earth to prevent too rapid drying of the filler. This shall be kept moist for at least four (4) days, and no traffic should be allowed on the brick surface for a period of at least eight (8) days, or longer, as the engineer may require on account of weather conditions.

**Protection
for Setting**

*NOTE: Box recommended by the National Paving Brick Manufacturers' Association.



Cement filled Brick Pavement without curbs with combined foundation and edging to protect and hold the sand filler,
an adaption particularly suitable for Parkways and Country Highways

ALTERNATIVES CONCRETE EDGING

If concrete edging is to be used, eliminate Sections 6 and 7 and substitute the following:

The concrete for the edging shall be composed of the kind of aggregate specified herein for the base. It shall be thoroughly mixed in a batch mixer and so proportioned that cubic feet of the concrete in place shall contain ninety-four (94) pounds of cement. The concrete shall be placed between the forms which have heretofore been set true to grade and alignment and held securely in place by stakes and clamps. The concrete shall be tamped with a spade until the mortar flushes against the form and to the surface. The upper surface shall then be finished by scouring with a wood float. The edging shall, upon completion, be kept covered for not less than days, to prevent too rapid drying.

CEMENT FILLED BRICK PAVEMENT WITH COMBINED FOUNDATION AND EDGING TO PROTECT AND HOLD THE SAND FILLER, AN ADAPTATION PARTICULARLY SUITABLE FOR PARKWAYS AND COUN- TRY HIGHWAYS.

The concrete foundation shall be constructed three (3) inches wider than the brick wearing surface and upon either edge of the foundation shall be built an edging of one and one-half ($1\frac{1}{2}$) inches by one and one-half ($1\frac{1}{2}$) inches. This edging shall be built immediately following the spreading of the foundation proper in suitable forms and tamped in sufficiently to form a perfect adhesion with the foundation.

CEMENT FILLED BRICK PAVE- MENT—Eliminating the Edging

Upon the foundation and cushion, shall be laid a brick pavement constructed as hereinbefore specified for the laying of brick pavements, except that the forms (instead of edging) to be used shall be two-inch planks, of the depth necessary to cover the depth of the pavement as specified, and shall be set firmly to grade and

made rigid by staking and bracing. The bricks in the roadway shall be laid as above specified. The edge of the pavement shall be so laid that all fractured ends of the blocks or bricks shall be laid toward the center of the pavement, leaving the edge finished and true to line, and that no bats shall be used smaller than one-half a brick, the end of the adjoining brick shall be broken off to accomplish this result. In all cases this pavement shall be finished with a cement filler, as hereinbefore set forth in these specifications.

After the pavement is completed, and the cement filler has set up sufficiently, the form boards shall be removed and the space filled in with the natural earth, thoroughly compacted; or, if a stone or gravel shoulder is provided in the specifications, the filling material shall be thoroughly rolled and compacted so as to conform to the cross-section of the roadway.

CRUSHED STONE FOUNDATION

If crushed stone foundation is to be used, substitute the following for Sections 10 to 20 inclusive:

Upon the sub-grade formed and compacted there shall be spread a foundation of clean crushed stone, of good quality, and of sufficient quantity, that after being bonded with enough screenings to fill all interstices and sufficiently flooded with water to allow of its being thoroughly compacted, and rolled with a three-wheeled self-propelling roller of not less than ten (10) tons in weight shall measure inches in depth. The top surface of this foundation shall be parallel with and at an elevation of inches below the finished arc of the pavement. The stone shall be practically uniform in quality and shall be crushed and screened so as to pass through a screen with openings inches in diameter, and be retained on a screen with openings one (1) inch in diameter—said foundation shall be laid, bonded and rolled in courses—the bottom course inches in depth and the top course inches in depth. After the limestone screenings are spread upon the stone, each course shall be rolled dry at least twice before water is applied.

OLD GRAVEL OR MACADAM FOUNDATION

If old gravel or macadam foundation is to be used, substitute the following in place of Sections 10 to 20, inclusive:

The present macadam or gravel foundation shall be cleaned of all earth and refuse and shall be scarified to such a depth as when graded to a true cross-section it shall have loose material over its entire surface to a depth of not less than two (2) inches. The surface of this roadway shall be built up with loose stone to such a depth as when rolled it will assume a cross-section of the finished foundation. The material used in building up the old roadway shall be crushed stone or gravel that will pass a one (1) inch screen and be retained on a one-fourth ($\frac{1}{4}$) inch screen and covered with enough screenings to fill all the interstices and sufficiently flooded with water to allow it to be thoroughly compacted, then rolled with a three-wheeled self-propelling roller not less than ten (10) tons in weight. The surface shall present a thoroughly bonded and filled cross-section so as to prevent the cushion from sifting through it.

NO. 2 PAVING BRICK FOUNDATION

If No. 2 paving brick foundation is to be used, substitute the following in place of Sections 10 to 20, inclusive:

Upon the sub-grade as heretofore specified shall be spread a base of sand two (2) inches in thickness which shall be brought to a perfect grade, conforming to that of the finished pavement. There shall be laid flatwise, parallel with the roadway, upon this grade thus prepared, a layer of No. 2 paving brick, the interstices of which shall be filled with sand. The brick shall be rolled as provided in Section 40.

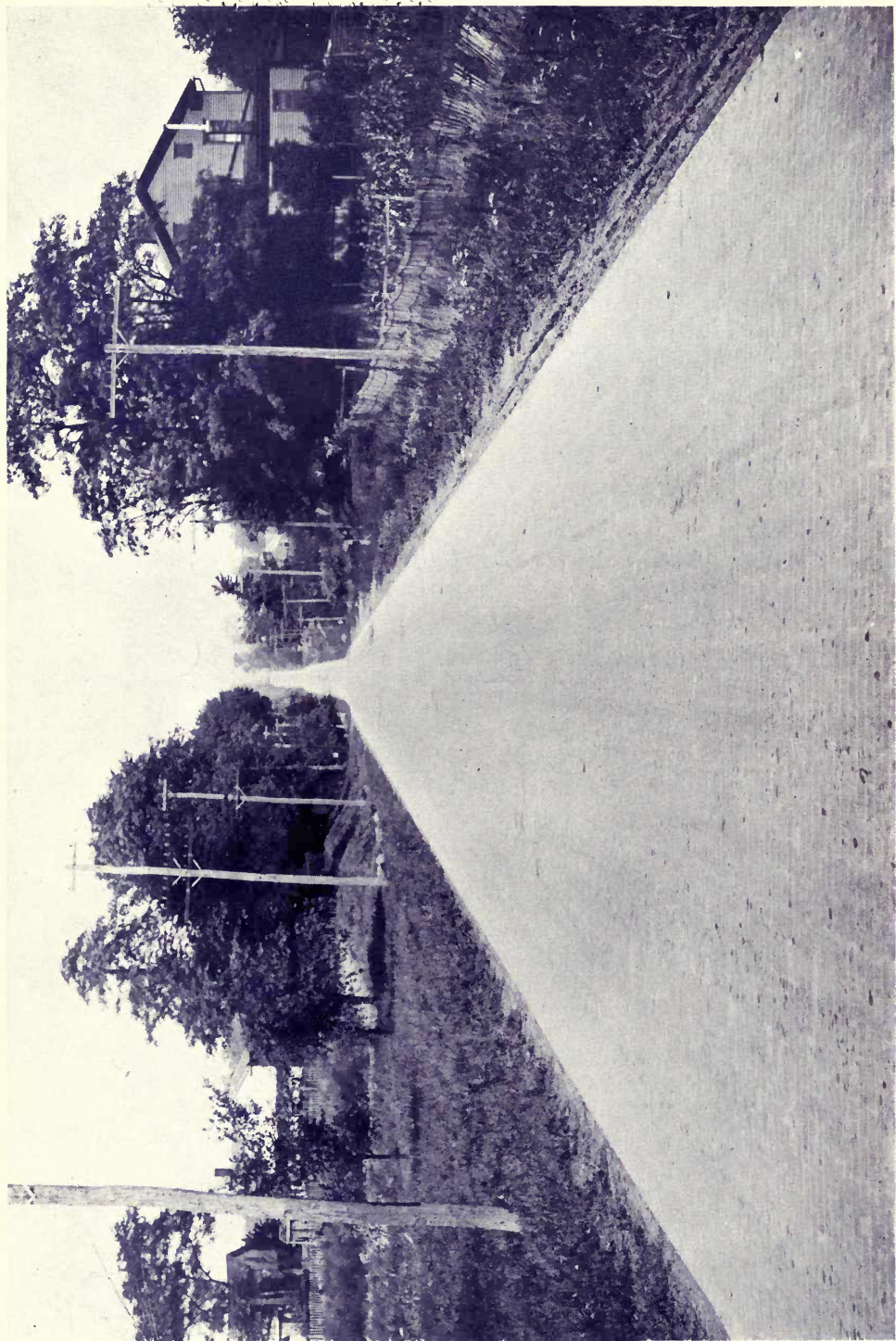
BRICK PAVEMENT ON NATURAL EARTH WITHOUT AN ARTIFICIAL FOUNDATION

In the construction of such a pavement, eliminate Sections 10 to 20, inclusive.

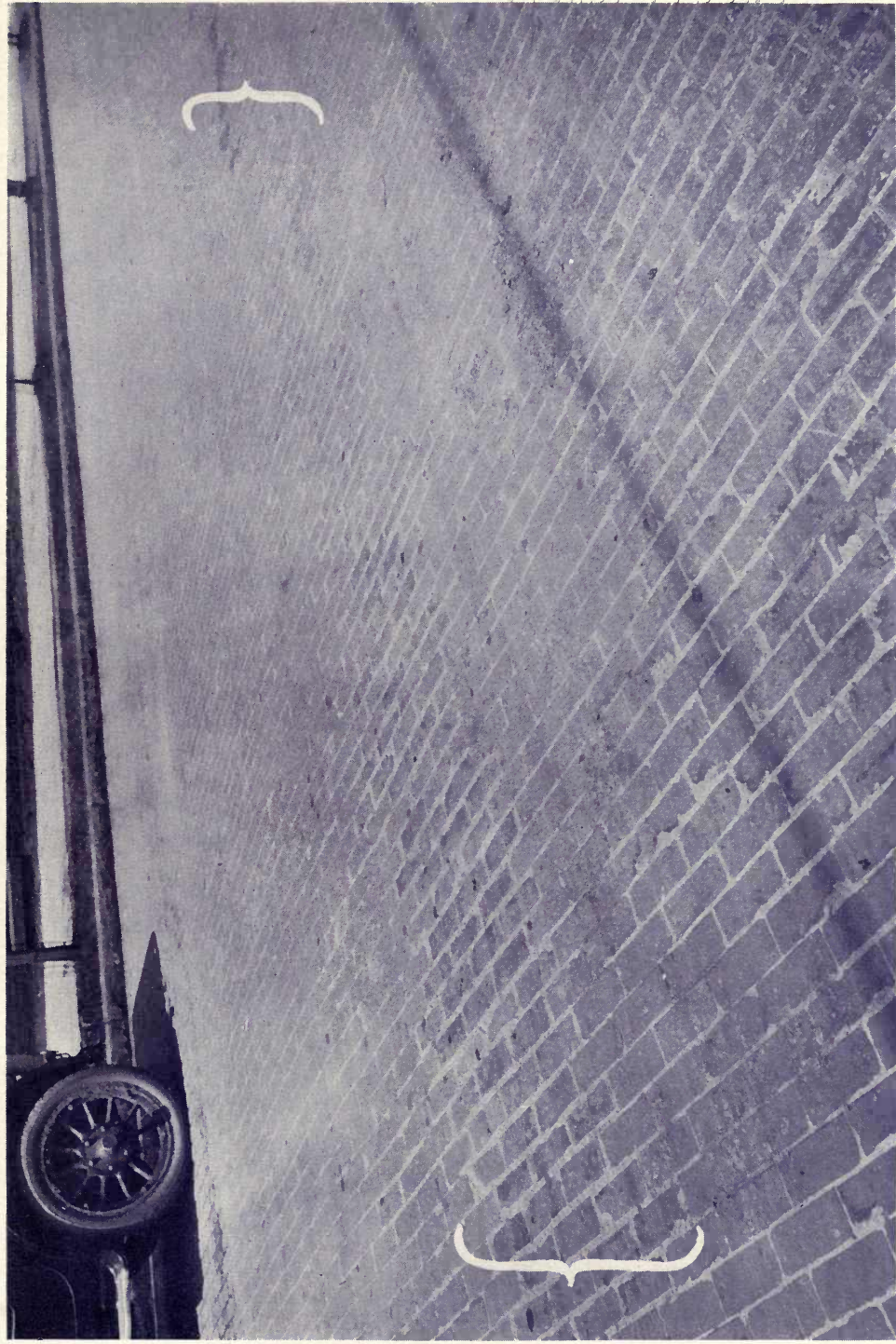
SAND FILLER

If sand filler is to be used instead of cement filler, eliminate Sections 43 to 47, inclusive, and substitute the following:

All of the interstices between the bricks shall be completely filled with clean, fine dry sand, which shall be spread upon the surface of the brick to the thickness of one-half ($\frac{1}{2}$) inch, over which shall be drawn a sweeper, roller or brush. This should be repeatedly gone over and additional sand added, until the interstices are completely filled and a surplus of one-quarter ($\frac{1}{4}$) of an inch of sand remaining on top.



Illustrating a vitrified brick country road built on an old gravel macadam foundation



Scene 4. Ansel Road skirting Rockefeller Park. The Brackets in the picture enclose the line of the trench in the middle of the road showing how it is possible to restore a pavement to its well nigh perfect condition when it is cut into

ALBERTA

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subject of Brick Pavement Construction, will be
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**NATIONAL PAVING BRICK
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